Cell Irradiations Using Low-energy Monoenergetic Photons

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Abstract No. Mari8037
Beamline: **X23A2**

Introduction: There is a good deal of evidence, both experimental and theoretical, that X rays below 50 keV are more biologically effective per unit dose than higher energy gamma rays. Given the increasing emphasis on mammographic screening for breast cancer, typically given with low doses of low-energy X rays (up to about 25 keV), it is of societal importance to provide realistic risk estimates for breast cancer induction from mammographic X rays.

Methods and Materials: In order to measure the biological effects of low-energy X rays relative to gamma rays, C3H10T1/2 mouse cells are being observed for oncogenic transformation, the *in vitro* analog of carcinogenesis, after being irradiated with monoenergetic X rays in the energy range 10-20 keV. The cells are plated in special dishes made of Kynar. After X-ray exposure the cells are replated onto standard culture dishes and incubated for 2 weeks and scored for colony formation (survival) or 6 weeks and scored based on colony morphology (transformation). Normal human fibroblasts are being irradiated in an identical manner and scored for various types of chromosome aberrations as observed by examination using a microscope.

Results: Preliminary results indicate there is indeed an increased biological effect for oncogenic transformation for 15 keV X rays relative to 250 kVp X rays but not for cell killing.

Acknowledgments: This work is being supported by DOE grant DE-FG02-98ER62686.

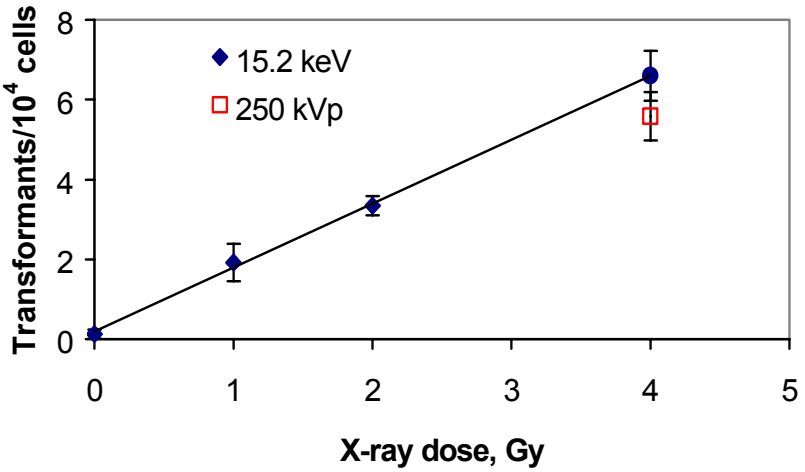

Figure 1. Transformation rate of C3H10T$_{1/2}$ cells after exposure to 15.2 keV monoenergetic X rays or 250 kVp X rays.

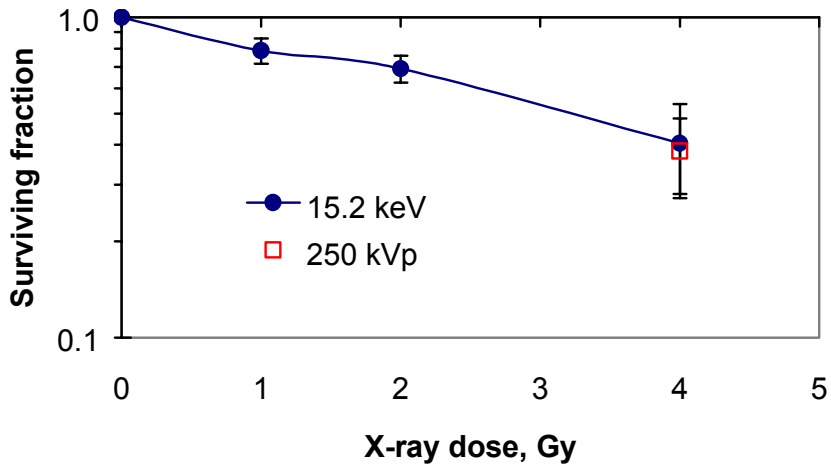

Figure 2. Survival of C3H10T$_{1/2}$ cells after exposure to 15.2 keV monoenergetic X rays or 250 kVp X rays.